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MECHANICS.

222. Proposed by W. J. GREENSTREET, Stroud, England.

Find the maximum angle of inclination to the line of greatest slope of a uniform rod resting on a rough inclined plane and capable of turning freely round a point on it.

II. Solution by the PROPOSER.

Let the point on the rod about which it turns be distant x and y from the ends ($x > y$). Let α be the inclination of the plane, and θ the angle the rod in its initial position makes with the greatest line of slope. Let W be the weight per unit length of the rod. Consider the normal reactions as acting at the mid points, respectively, of AO , OB , where AB is the rod and O the pivot. μ is the coefficient of friction.

Resolving perpendicular to the plane for each part AO , OB ,

$$R = \frac{x}{2} W \cos \alpha, \quad R' = \frac{y}{2} W \cos \alpha.$$

There is an unknown force at O . Take moments at O ,

$$\mu \cdot \frac{x}{2} R - \frac{x^2}{4} W \sin \alpha \sin \theta + \mu \cdot \frac{y}{2} R' + \frac{y^2}{4} W \sin \alpha \sin \theta = 0,$$

and substituting for R , R' ,

$$\mu \frac{x^2}{4} W \cos \alpha + \mu \frac{y^2}{4} W \cos \alpha = \frac{W \sin \alpha \sin \theta}{4} (x^2 - y^2),$$

$$\mu \cot \alpha (x^2 + y^2) = \sin \theta (x^2 - y^2).$$

$$\therefore \sin \theta = \mu \cot \alpha \frac{x^2 + y^2}{x^2 - y^2}, \quad \theta = \sin^{-1} \left(\mu \cot \alpha \cdot \frac{x^2 + y^2}{x^2 - y^2} \right).$$

224. Proposed by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

A steel clock spring $w = \frac{7}{8}$ inch wide, $t = \frac{1}{32}$ inch thick, is wound around an axle $d = \frac{1}{4}$ inch in diameter. Find the greatest available moment for running the clock, using a factor of safety $f = 6$.

Solution by the PROPOSER.

Let $OH = r$ = radius of curvature; $HL = y$ = distance of any fiber from the gravity axis HH ; x = length LM of this fiber; $MS = dx$; $RH = z$ = distance between the neutral axis and the gravity axis; $\angle MRS = \phi$, $\angle AOB = \theta$; $s =$